

STATED MEETING, HELD OCTOBER 7, 1912

DR. GWILYM G. DAVIS, President, in the Chair.

SPRAIN-FRACTURES.

DR. PENN G. SKILLERN, JR., presented skiagraphs of cases of sprain-fracture as follows:

CASE I.—*Sprain-fracture of coracoid process of scapula.* A football player, aged 20, fell upon his right shoulder, causing luxation at acromioclavicular joint. Skiagram (Fig. 1) showed a scale of bone torn off from the coracoid, probably from traction upon the coracoclavicular ligaments. Fractures of the coracoid process are rare, their line usually involving the base. The frequency of combination of this sprain-fracture with luxation at this point has not been established.

CASE II.—*Sprain-fracture of wrist.* This skiagram (Fig. 2) of an ordinary "sprained wrist" showed avulsion of a scale of bone from the dorsum of the carpus, probably from the os magnum. This scale was not palpable on account of the swelling, but there was distinct localized tenderness over it. A skiagram should be made of every "sprained wrist" and the treatment should be immobilization.

CASE III.—*Sprain-fracture of anterior superior spine of ilium.* Male, aged 16, during a foot race felt something snap in upper part of left thigh, but finished race (five yards). Pain aggravated by flexion of thigh. Skiagram (Fig. 3) showed avulsion of a shell of bone from the anterior superior spine and its immediate vicinity, evidently from action of the sartorius muscle.

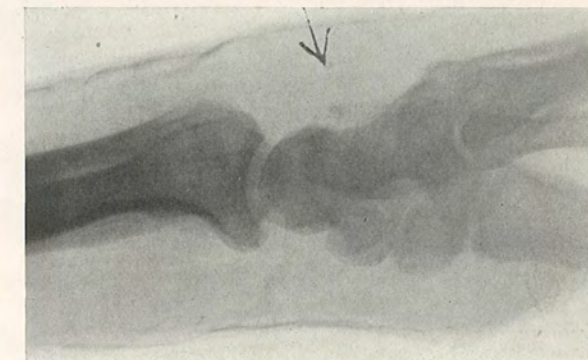
CASE IV.—*Sprain-fracture of cuboid.* S. K., male, aged 23. Twisted left foot inward and heard something crack, immediately after which swelling appeared at external tarsometatarsal joint. No previous injury here. Examination showed swelling and ecchymosis between external malleolus and this joint, and definitely localized tenderness at antero-external corner of cuboid, suggesting sprain-fracture of same. Skiagram (Fig. 4) showed chipping off of a sliver of bone from antero-external corner of

FIG. 1.



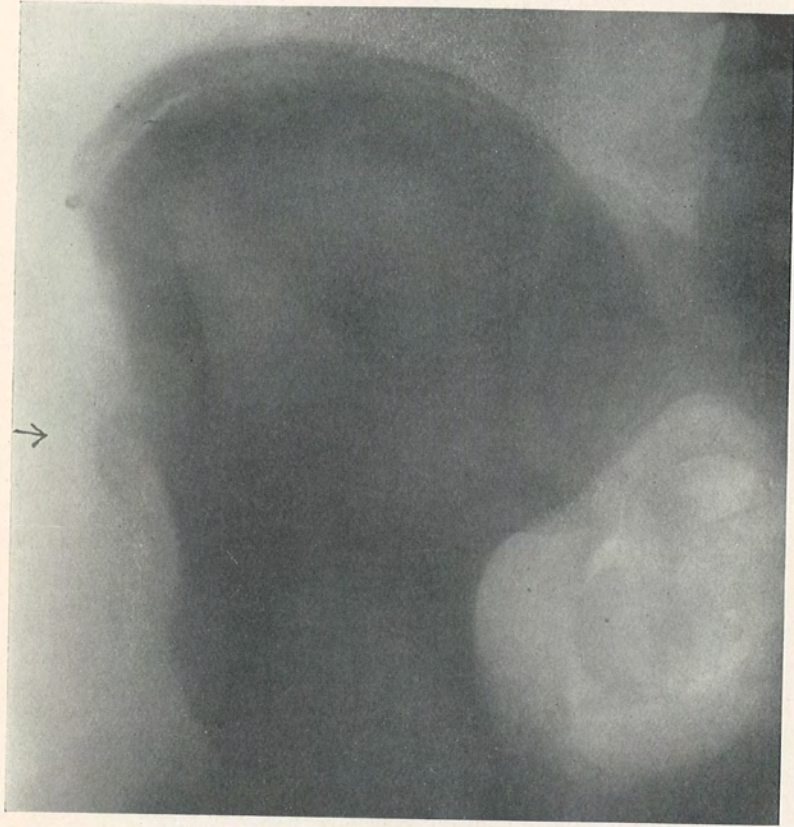
Fracture of coracoid process scapula.

FIG. 2.

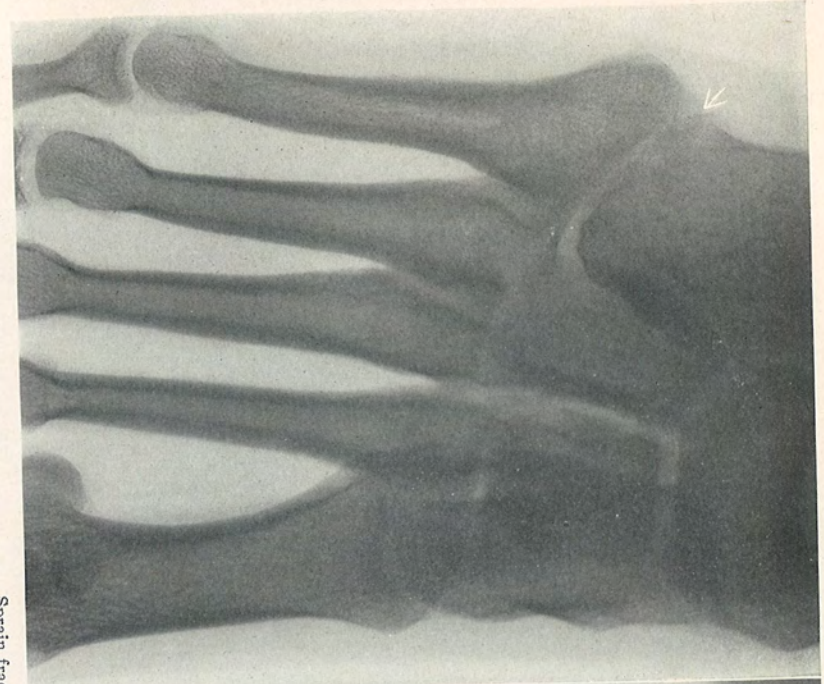


Sprain. Fracture of wrist.

FIG. 3.



Sprain. Fracture of anterior superior spine of ilium.

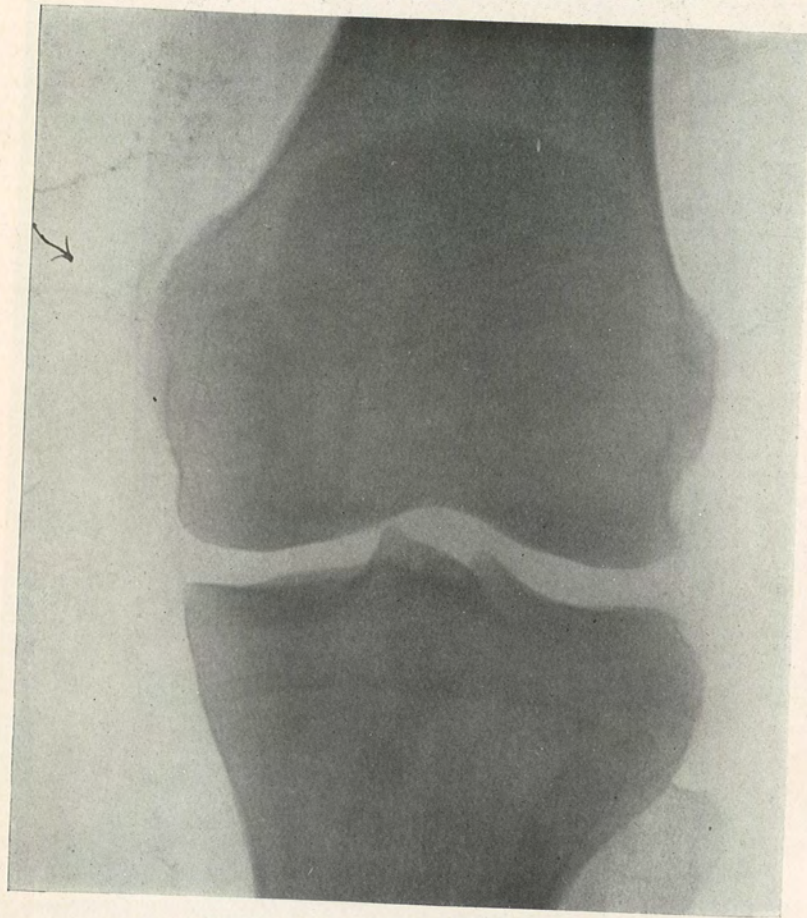


Sprain fracture of tibia.



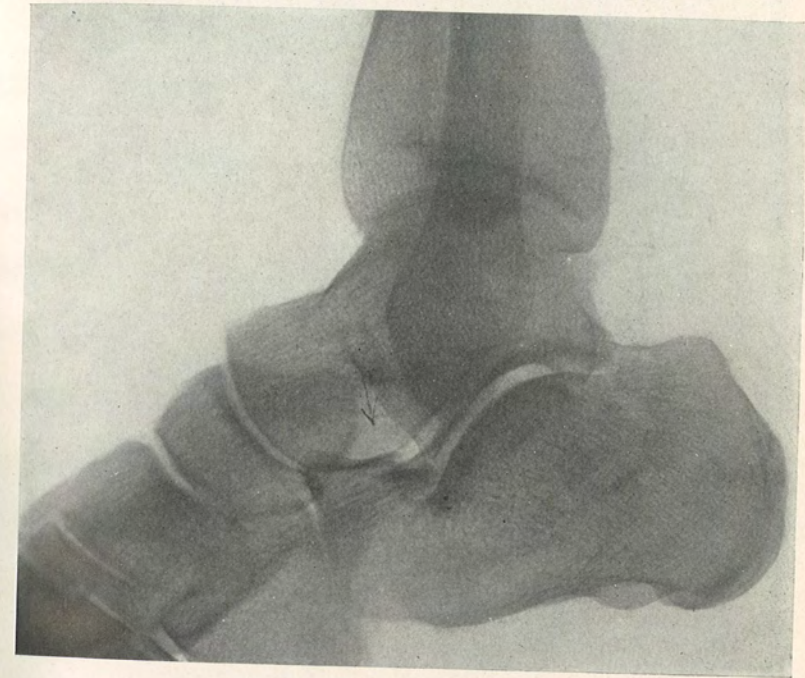
FIG. 4.

FIG. 5.



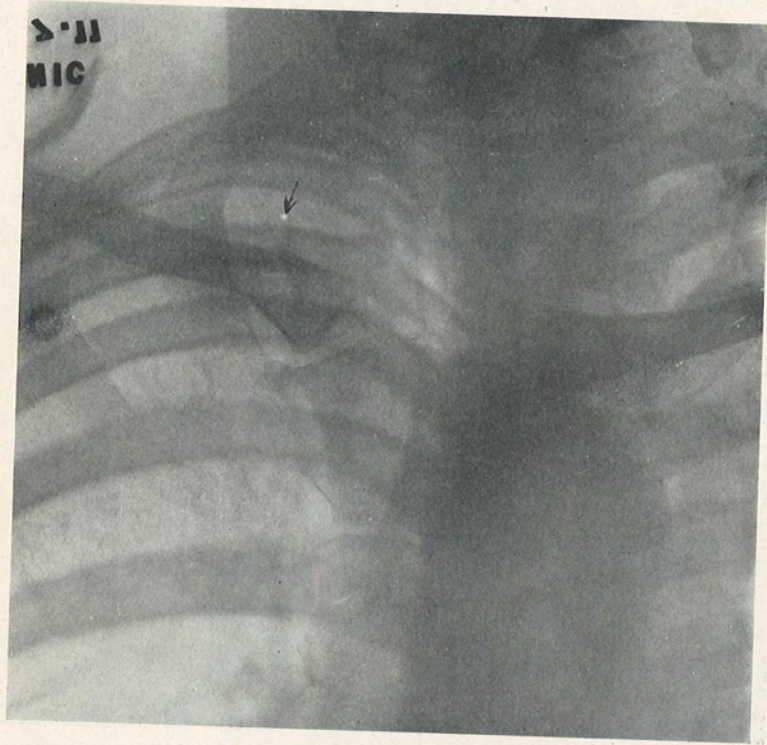
Separation of adductor tubercle of the femur.

FIG. 6.



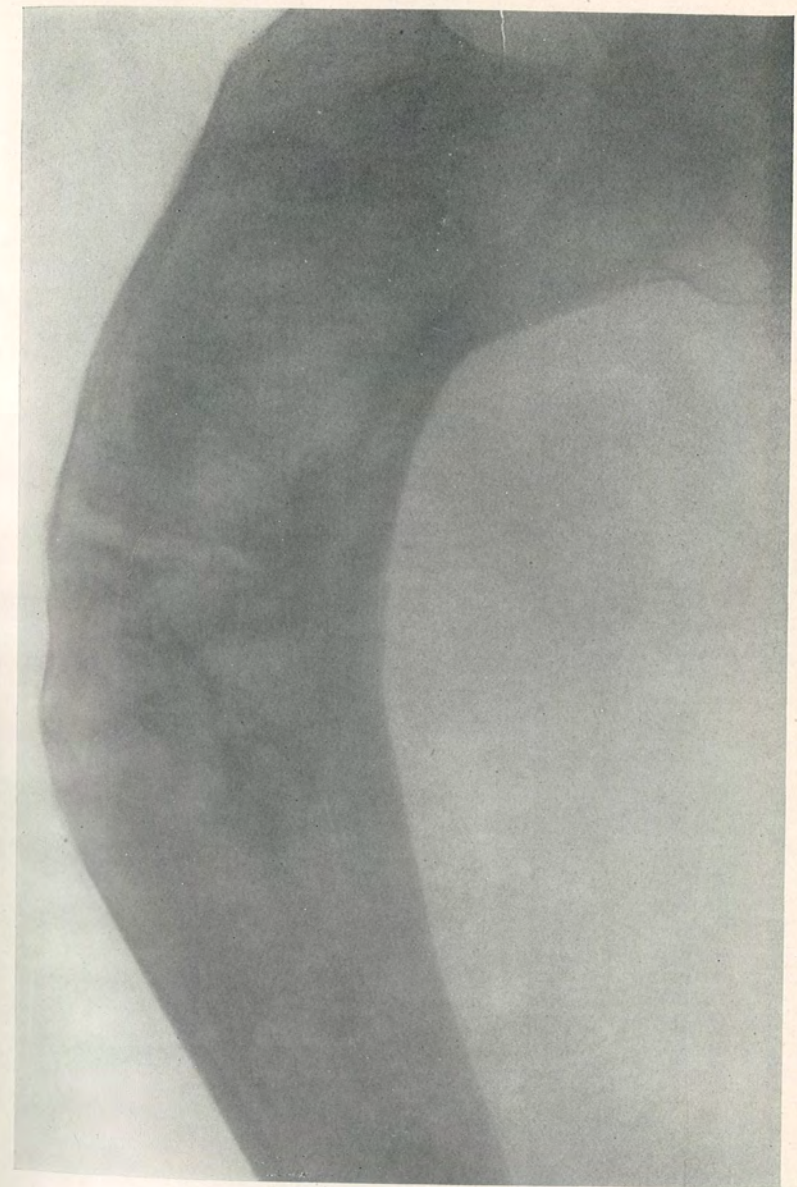
Fracture of sustentaculum tali.

FIG. 7.



Fracture of internal end of clavicle.

FIG. 8.



Hereditary syphilis of femur.

cuboid, evidently from overstretching of the dorsal tarsometatarsal ligament at this site. Foot strapped in over-abduction with relief of pain.

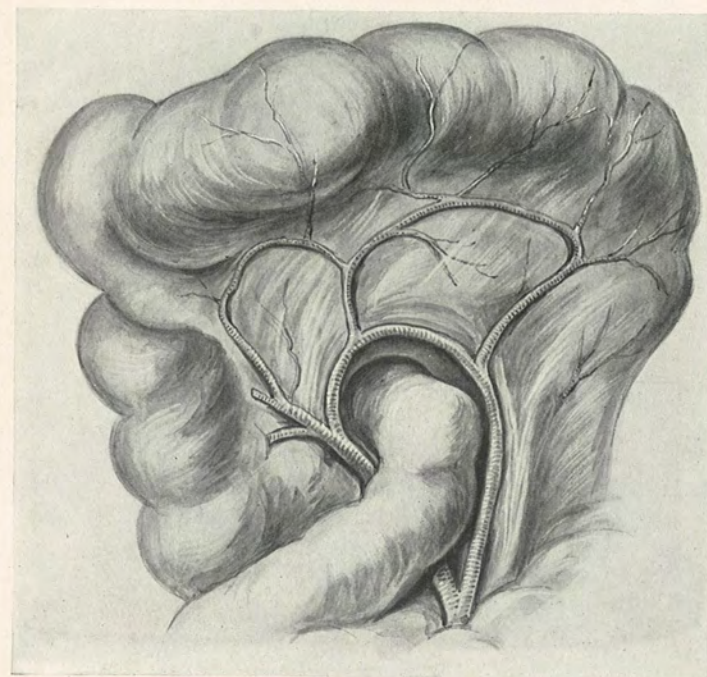
CASE V.—*Fracture of adductor tubercle of femur.* Boilermaker, aged 20, received a blow upon the lower part of the left thigh. There was localized tenderness just above internal condyle. Skiagram (Fig. 5) showed separation of adductor tubercle, and the tendon of the adductor magnus leads to it as a shadow.

CASE VI.—*Fracture of sustentaculum tali.* Male, aged 35, fell from a height of 10 feet, landing on feet. Skiagram (Fig. 6) showed an impaction of the sustentaculum into the body of the os calcis.

CASE VII.—*Fracture of clavicle, sternal end.* Male, aged 40, was struck by a heavy object upon the right clavicle. Examination revealed a dense and tender swelling over the clavicle near the sternum, which to inspection resembled a neoplasm and a luxation at the sternoclavicular joint. Skiagram (Fig. 7) revealed a line of fracture within an inch of the sternoclavicular joint. In the literature this fracture is very infrequently met with.

CASE VIII.—*Syphilis hereditaria tarda of femur.* Male, aged 22, farmer. Except for lesion in left thigh is robust and healthy. Three years previous to admission had what was diagnosed and treated as a fracture of the femur. For several years before that had had trouble with left femur, giving rise to a perceptible limp. Examination revealed marked bowing of left thigh, the point of greatest convexity being 13 cm. below the anterior superior iliac spine. Left thigh 6.5 cm. shorter than right. On palpation the upper part of the femur was of great uniform diameter, markedly roughened, but not tender. No inflammatory manifestations, no areas of softening, no sinuses. There was no history of tuberculosis, malignancy, or syphilis in the family. Diagnosis of late hereditary syphilis of femur made. Skiagram (Fig. 8) revealed marked increase in diameter of upper half of femur; obliteration of medullary cavity; alternating areas of osteoporosis and osteosclerosis; and the line of an incomplete fracture at the point of greatest convexity of the femur. Wassermann reaction positive (Ivy). Mercury and iodide treatment was instituted and an orthopædic splint adjusted by Dr. Willard so as to transfer weight supported by left lower limb from ground to pelvis as a base of support. After 8 months, while the

FIG. 9.



Mesocolic fossa of extraordinary depth.

patient had better use of and less inconvenience with the limb, yet skiagrams indicated but little change in the condition of the bone, and quite recently a dose of neo-salvarsan was administered.

CASE IX.—*Mesocolic fossa of extraordinary depth.* Found in a female body in the angle between the duodenojejunal flexure and mesocolon, this fossa measured 3.5 cm. in width, and 4 cm. in depth (Fig. 9). The mouth of the fossa was bounded on the left by the left colic branch of the inferior mesenteric artery and vein; in front by an arterial arch which connects the middle colic artery with the left colic. Leaving this arch at its middle and behind it is the inferior mesenteric vein, while attached to the arch and enclosing it is the posterior lamella of the mesocolon. On the right the mouth is bounded by the middle colic artery and the trunk of the superior mesenteric. Posteriorly is the third portion of the duodenum and the renal artery.

The anterior wall of the pouch is bounded by the pancreas; the posterior wall by the duodenojejunal flexure; the right by the superior mesenteric vessels; and the left by the descending colon and anterior half of the left kidney.

This fossa offers an excellent site for lodgment of an internal abdominal hernia.

DR. W. G. ELMER remarked that one should be careful not to be led into error by examination of a late X-ray picture. If the ligament tears away the osteogenetic layer from the bone, it is open to supposition that a small island of bone may be formed in the vicinity of the bone from which it was supposed to have been torn away.

DR. ASTLEY P. C. ASHHURST said that it seemed to him that there was no need to exaggerate the frequency of sprain-fractures, when it was possible to explain the lesions in other ways. Drs. Ross and Stewart (*ANNALS OF SURGERY*, 1912, ii, 599, Fig. 4) included in their series of sprain fractures an experimental fracture of the coronoid process of the ulna which was quite clearly caused by direct violence and not by ligamentous distraction. So in the case reported by Dr. Skillern, it seemed to Dr. Ashhurst that the fracture might very well have been caused by direct violence.

THE REDUCTION OF OLD UNREDUCED DISLOCATIONS OF THE SHOULDER.

BY T. TURNER THOMAS, M.D.,

OF PHILADELPHIA.

Associate Professor of Applied Anatomy and Associate in Surgery in the University of Pennsylvania; Surgeon to the Philadelphia General Hospital; Assistant Surgeon to the University Hospital.

THE best treatment for the old unreduced dislocations of the shoulder is still undecided, although there is probably no question concerning traumatic conditions of the shoulder that has been the subject of more prolonged and earnest discussion. The most definite result that has been attained is the general tendency toward earlier operative interference, the chief advantage of which is that the severe force necessary for the reduction can be applied with less danger of fracture of the humerus and with greater safety to the surrounding important vessels and nerves. But the results of such operations are far from satisfactory, in many cases the reduction still remaining impossible and the operation frequently ending in an excision of the head of the humerus. That nearly all dislocations become practically irreducible after three months, and that they often become very difficult of reduction in as many weeks, is generally conceded. As a medical student I was taught that attempts at reduction should be made up to three months, and that even after that, operation was not of necessity indicated. There was a considerable difference in the views of teachers then as now. Although Kocher¹ operated as early as five and seven weeks in some cases, his record of non-operative reductions has probably never been equalled. He reported 25 successful reductions out of 28 cases, after 5 months and 22 days in the longest and 5 weeks in the shortest. The position taken by Lund² 15 years ago probably represents the present general tendency among surgeons as

well as any. According to Lund, "after more than six weeks have elapsed, such changes have usually taken place as to render success, with such manipulative methods as it is safe to employ without danger of fracture of the humerus or rupture of the axillary artery, improbable. If reduction is to be accomplished at all, it is to be accomplished by arthrotomy, with or without resection of the head of the humerus." He refers to the "remarkable case of Burrell" in which the reduction was accomplished without operation after eight months. Cavaillon,³ in his report of a case reduced after six months by Jaboulay, says that Koenig reduced one after eight years and Sedillot one after one year without operation. The opinion of the profession generally, at the present time, is probably expressed in the statement of Forque and Reclus, quoted by Cavaillon, to the effect that success by manipulative methods in such old cases made them pernicious examples, evidently, because they encouraged too daring and dangerous attempts by others. The axillary vessels have been ruptured in rare instances and the humerus fractured many times. Kocher fractured the humerus in the three cases in which he failed to reduce the dislocation, and likewise in one of his operated cases in the efforts to reduce by his method before operation, resecting the fractured head in the operation. In another of the operated cases the upper end of the humerus was fractured in attempts at reduction before the patient came to the hospital.

It would be generally admitted that the average functional result following a non-operative reduction is better than that following an operative reduction. Jonas,⁴ in supporting the operative method, says: "The division of muscles, especially the deltoid and the subscapularis, has often been extensive and the separation of fibrous and capsular structures extended over a wide area, before reposition became possible." I doubt if as much damage is done to normal structures in the usual reduction by manipulation, so that the return of function should be more rapid and more complete. It is very likely, however, that complete return of motion and function is rare

even after the non-operative reduction, except perhaps in cases of two or three weeks' duration. The increased tendency toward operative reduction is to be explained by the almost insurmountable obstacles to reduction in many cases, and the present-day well-developed technic for operations in general. Yet, notwithstanding the very large number of operations which have been done by the best surgeons, we have no reason to be particularly proud, even when the reduction has been accomplished. The mortality of operation has been considerable, while the non-operative reductions have a much better record in this respect. Kocher, for instance, had one death from sepsis in his eight operative cases, but none in his 25 successful and three unsuccessful non-operative cases. In another operative case, a sinus was still present nearly seven years after operation.

One is apt to underestimate the difficulties until he has attempted the reduction in one of these cases. The humeral head is not far removed from its normal place in the socket. The anterior glenoid margin, in the subcoracoid variety, is in contact with the cartilaginous portion of the head, above and posteriorly, just anterior to the anatomical neck, so that the greater tuberosity is still in the glenoid cavity or directly over it, and only the rounded portion of the head is anterior to the glenoid margin. Yet to bring the whole of the head back into the socket, after a few weeks, is often very difficult. The particular obstacle to reduction has never been satisfactorily demonstrated.

During the last four or five years I have had considerable interest in the results of traumatic conditions about the shoulder, many of which are very obscure. I began early to pay attention to the old unreduced dislocations and to theorize, on the basis of the cadaver dislocations, as to the cause of the difficulties in reduction. The first fact to attract my attention was that the reduction, which is usually very easy under full anaesthesia at the time of the accident, becomes very difficult in two or three weeks, and that without regard to whether the X-ray shows a concomitant fracture or not.

To my mind that meant that the obstruction was in the soft tissues. My first conclusion was that it was due to a shortening of the muscles and that it was somewhat of the same nature as that encountered in an old ununited fracture. In the meantime I had been trying to work out the solution of the problem of other conditions in this region, as the recurrent dislocations, stiff and painful shoulders, and some traumatic brachial paralyses. I ultimately concluded that these conditions were all the results of dislocations and their analogous but milder conditions, the sprains of the shoulder, and that the essential lesion in all was the laceration of the axillary portion of the capsule. I have satisfied myself that the capsule of the shoulder-joint is not the negligible structure that it is generally thought to be, and that the best treatment of these cases is that directed to the cicatricial changes which have occurred at the site of the capsule tear. I then concluded to study, so far as my limited opportunities would permit, the possibility or probability that the chief resistance to reduction in old unreduced dislocations came from the same cicatricial changes, which tend to fix the head in its dislocated position. These changes could advance far enough in two or three weeks to offer a considerable resistance to reduction, and the longer the dislocation remained the greater would be the contraction and resistance of the cicatricial tissue. I had not at that time, but have since studied Kocher's paper in which his conception as to the obstacles was based upon his previous cadaver observations and upon his experience with 36 cases, eight operative, and upon an autopsy on a case in which he had not attempted reduction. Although he had attached considerable importance to irregular bone formation and fragments, he says that his main contention, which he justified by his operative cases, was that the reduction was obstructed not by adhesions between the humeral head and scapula, but by the contraction in the region of the old capsule tear between the margins of the glenoid and the anatomical neck of the humerus. These closed the capsule tear, he says, and hindered the raising of the capsule from

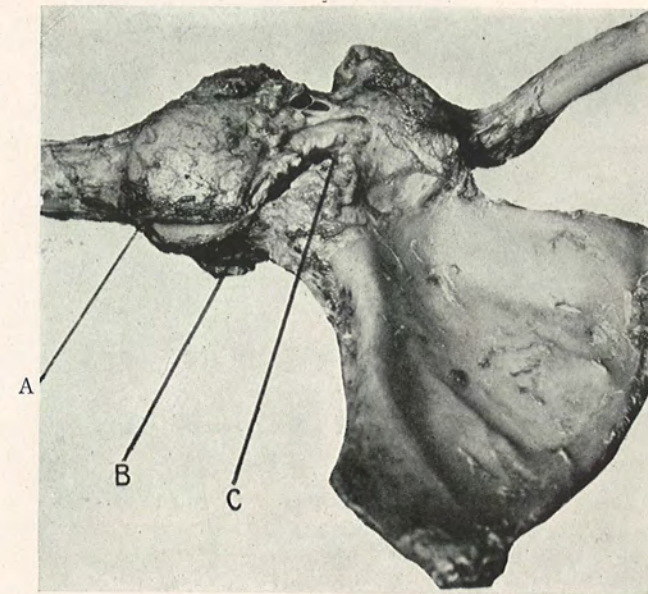
the glenoid so that the head could not enter. In other words the margins of the rent in the capsule, which he believed offered a considerable resistance to reduction in the recent condition, now became thickened and contracted by cicatricial tissue and thus accounted for the increased difficulty. In his post-mortem dissection, however, he "found no capsule tear anywhere" but where it was originally, "a closed fibrous tissue covering passed over the head everywhere."

His conception of the rent in the capsule was obtained from his study of the dislocation on the cadaver.⁵ But in producing it he followed Malgaigne's method of first dividing the capsule by an incision in the axilla, from the lower border of the subscapularis to the origin of the triceps. As I understand it, he made a longitudinal incision from the glenoid to the humeral attachment, in the lowest part of the joint. He then produced the dislocation by raising the arm to the vertical position "with force" and pushed it outward. On dropping the arm he found that he had a complete subcoracoid dislocation. If the head escaped through the opening in the capsule which he made with the knife and which was longitudinal, the margins would probably close about the neck of the humerus and offer a considerable resistance to reduction. On the basis of observations made upon capsule specimens dissected after a dislocation had been made by forced abduction and upon intact capsule specimens, I concluded that such a result is impossible. I have since produced a dislocation on the cadaver after making such an incision in the capsule as Kocher describes and am still more convinced that the head cannot escape from the socket through such an opening (Fig. 1, AB). As the arm is carried into abduction, the axillary portion of the capsule becomes tense and limits the abduction (Fig. 2). The effect upon the longitudinal opening is to bring its margins together so that the dislocation cannot occur until the abducting force has made a more or less extensive new tear in the capsule at an angle with the longitudinal opening (Fig. 1, BC). The presence of the incised opening probably influences somewhat the direc-

tion and extent of the tearing, but before the dislocation could occur there would be a more or less transverse rent that, added to the incised opening, would present a very large opening into the joint, in the axillary or antero-inferior portion (Fig. 3). Without such an incision, the tearing usually takes place from the glenoid or humeral attachment. Since the capsule conditions which Kocher emphasized in his description of the cadaver dislocation tallies almost if not exactly with what I have seen repeatedly in my cadaver work, I believe that his longitudinal incision had only little influence upon the size of the transverse rent which permitted or was caused by the dislocation. As I have seen the laceration of the capsule, its margins cannot become constricted about the neck of the humerus in a recent dislocation. It is too extensive and its transverse direction will not permit it (Fig. 4). This view is not original since Professor G. G. Davis taught his classes in applied anatomy at the University of Pennsylvania for more than ten years that the margins of the rent in the capsule would not prevent reduction of a recent dislocation.

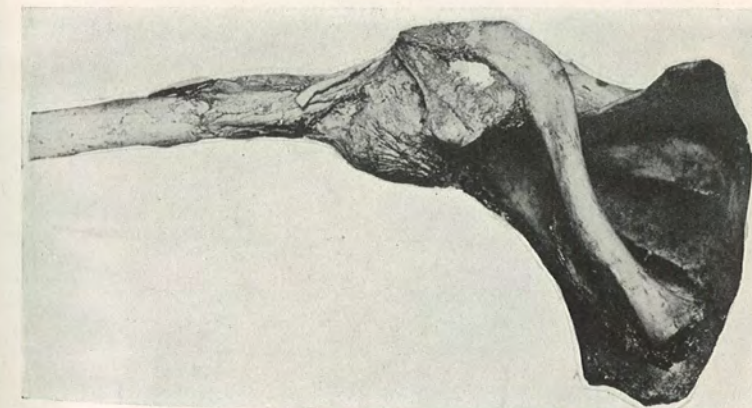
On the other hand I find that the conclusions which I had reached concerning the cicatricial changes in the capsule and upon which I had based my efforts at reduction in my first four shoulders (three patients), did not differ greatly from those which Kocher had reached. The one difference which I regard as important, *i.e.*, as to the importance of the margins of the rent in resisting reduction by constriction about the neck, has led me to reject the Kocher method of reduction and to employ the old method of abduction, or one of the abduction methods, and because of the good results which I have obtained with it have concluded to report the results of my observations and to support the method which I think is best. While Kocher says that his main contention which concerned the cicatricial changes at the site of the tear in the capsule was based upon his operative cases, it is evident that his interpretation of the effect of these changes was based primarily upon the conditions found in the cadaver dislocations. He assumed, therefore, that the subcoracoid dis-

FIG. 1.



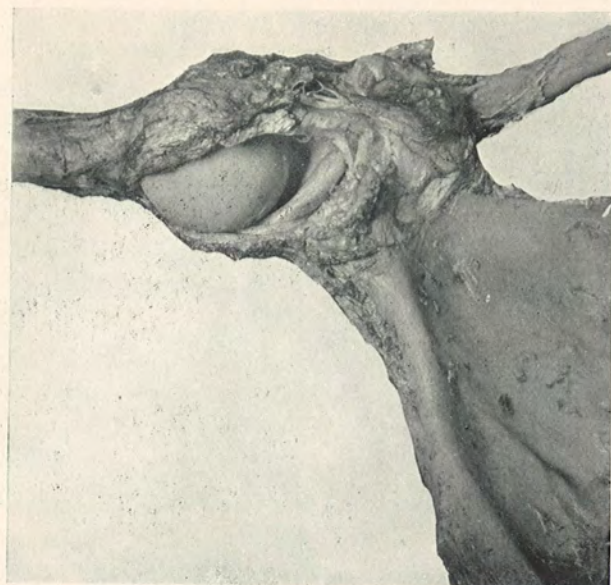
Capsule preparation from cadaver dislocation produced by Malgaigne method which was employed by Kocher. View from below and anteriorly. *A, B*, opening made in lower part of capsule by incision; *B, C*, increase in capsule opening made in producing dislocation by abduction after incision was made. At *B* the capsule margins were approximated by a suture, to indicate the junction of the incised and tear portions of the capsule opening necessary for the occurrence of the dislocation.

FIG. 2.



Limit of abduction with scapula fixed in normal position (when arm is hanging at side). Axillary portion of capsule tense and humeral head held firmly against glenoid surface. Further abduction will tear axillary portion of capsule.

FIG. 3.



Same preparation as in Fig. 1, showing size of capsule opening produced by the combination of incision and tearing, and necessary for the occurrence of the dislocation.

FIG. 4.



Capsule specimen of subcoracoid dislocation produced by forced abduction without incision. Upper margin of capsule tear carried forward with head under coracoid process. Humeral head has not passed through the rent, the margins of which do not constrict the neck. Therefore, in a recent dislocation they will not obstruct the reduction. The gap in which a portion of the head presents will later be filled in by cicatricial tissue, which, in an old dislocation, will offer the chief obstacle to reduction.

location in the cadaver produced by forced abduction, since that is how he produced it, represents the same condition as the subcoracoid dislocation in life. The work which I have already done on traumatic conditions of the shoulder is based upon the same assumption, with the further conclusion that all anterior dislocations are essentially the same. The cadaver dislocation, therefore, makes an excellent basis upon which to build up the probable results in life of the later cicatricial changes. In this way I determined to my own satisfaction the pathology of the recurrent dislocation, and upon this basis have now operated on 12 cases and have assisted in another, with only one recurrence of the dislocations. I believe that there is very little difference between the capsule conditions developing in the recurrent and the old unreduced, except that in the latter the continuance of the dislocated position has permitted the capsule about the humeral head to become firmly fixed in its abnormal position. In both conditions the capsule is completely repaired, but to meet abnormal conditions, *i.e.*, to permit the humeral head to occupy the dislocated position. Kocher "found no capsule tear anywhere" in his autopsy but "a closed fibrous tissue covering passed over the head everywhere." No one has yet reported that he found the tear unhealed in an operation on a recurrent dislocation.

In my effort to locate the obstructing portion of the changed capsule, I have taken for the type, as did Kocher, the dislocation without fracture, in which the upper and posterior portion of the capsule was not torn. With the head in the abnormal position, the lacerated capsule would, of necessity, adapt itself to the altered relations of the articulating surfaces and this rearrangement can be observed on the cadaver (Fig. 4). When the tear is from the glenoid margin, which is probably the most common variety, the torn portion of capsule attached to the humerus maintains about its normal relation to the head as does the capsule to the neck and head of the femur in the corresponding condition in the hip (as shown by Allis⁶). The head of the humerus protruding at the site of the rent, but not completely through it, separates

the upper torn edge of capsule from its normal place at the glenoid margin, so that later when the gap has been filled in by new cicatricial capsule this portion of the repaired capsule is longer than normal by the width of the gap. Therefore, the obstruction cannot come from this portion of the repaired capsule. The posterior portion, which is dragged tensely over the glenoid cavity by the head in its dislocated position, will be kept continuously at its normal length so that, because of its length and the fact that it is not put under tension in the reduction, it will not resist the return of the head to the socket, unless it becomes adherent to the glenoid surface as Kocher found in one of his operated cases. Even if it does, the traction on the humerus in abduction might separate it during the reduction. But in the regions between these two portions the capsule conditions are not so favorable to reduction. The undamaged portions at the upper and lower limits of the rent pass forward and inward with the head, so that instead of having a vertical direction as in the normal condition they now are about transverse, and as Kocher showed for the upper portion are rolled somewhat into a cord (Fig. 5). Cicatricial tissue fixes them to the corresponding portions of the scapula, the upper portion near the base of the coracoid process and the lower portion near the bottom of the glenoid cavity. I believe that these two portions of the capsule must be torn more or less before the head can be brought back to the socket, and that it will require considerable force to tear them.

I had determined that traction on the humerus at about a right angle with the trunk, firm fixation of the scapula, and traction or direct pressure on the head toward the socket was the safest and best method of breaking this resistance, but was still concerned about the risk to the axillary vessels and nerves. I knew that severe force had been applied by a variety of methods in a large number of cases, and that vessel rupture, at least, was very rare. A study of the normal relations and those of the dislocation on the cadaver gave some interesting results in connection with this phase of the

subject. Normally, the capsule is practically completely covered by the short rotators. With the exception of the circumflex, none of the large vessels and nerves lies directly in contact with the capsule, the circumflex nerve and posterior circumflex vessels being in contact with a small portion of it near its humeral attachment. In an anterior dislocation, the humeral head passes downward and forward, and overlaps for a short distance the glenoid margin but still remains under the subscapularis, which continues to separate it from the large vessels and nerves. These are adherent to the upper surface of the muscle, and do not move with the head when it is being luxated, so that they come to occupy a position anterior to the dislocated head, and in my opinion are not in danger from direct pressure on the head toward the socket, if that pressure is made over the most prominent portion of the head and from a position somewhat posterior. Kocher emphasized the danger to these structures from the heel in the axilla in the Cooper method, which seems to have been the most popular one in recent dislocations up to that time, and it is this danger which was probably the most important factor in obtaining for the Kocher method the rapid and extensive recognition which it received. While they should always be respected, I believe that the danger to the vessels and nerves has been over-rated, especially when the arm is in abduction. I have now operated on two cases of recurrent dislocation of the shoulder through an axillary incision behind the large vessels and nerves, reaching the capsule in the space between the lower border of the subscapularis and the adjacent border of the latissimus dorsi. With a little traction upward on the subscapularis I came directly upon the most prominent portion of the head. This was maintained in the dislocated position to bring it nearer to the surface. The large vessels and nerves did not come into view at any time. The circumflex nerve and vessels were below the most prominent portion of the head in both cases, but in one the subscapular branches of the axillary vessels lay almost directly over the prominence. Although much direct pressure was made on the

head in the reduction, in all my cases, in some of them very severe, not one complained of any disturbance that would indicate any damage to vessels or nerves. If the subscapular vessels came in the line of pressure, either they could tolerate very much pressure without suffering or they moved away as the pressure increased, as could easily happen, since the comparatively thick subscapularis muscle intervenes between the vessels and the humeral head. In view of these observations, the large number of reductions and attempts at reduction in old dislocations with severe force and the infrequency of nerve or vessel rupture, I believe that usually dangerous involvement of the nerves and vessels in the cicatricial tissues does not occur. Guibe⁷ studied the lesions of the axillary vessels complicating dislocations of the shoulder, with special reference to the treatment of these complications. He says that it is difficult to determine their relative frequency, that they are very rare but not exceptional. Hennequin did not mention them in his treatise on dislocations, which shows, Guibe thinks, that he had no personal experience with them, although he probably saw and reduced more dislocations of the shoulder than any other man in France, at least old dislocations. Of the 78 cases collected from the literature by Guibe, it appears that in only 31 were the axillary vessels ruptured during attempts at reduction of old dislocations, and most of these were of six weeks' duration or less. In the remaining cases the complication occurred at the time of the dislocation or of the reduction immediately afterward. With the abduction method which I have employed there should be the least danger, because by it the head is dragged back to the socket by the shortest and most direct route. Kocher in describing the findings in his autopsy case said that the nerve cords and vessels were somewhat removed from the head. I searched several museum collections for a wet specimen of an old dislocation but failed to find one.

To formulate a theory is one thing, to apply it in the presence of danger is quite another. I was prepared, however, to test it when the opportunity came. I wish to acknowledge

here that I was further prepared by a statement made by Professor Edward Martin, based upon his operative experience, to the effect that in his opinion the chief obstacle to reduction was ligamentous. This was the main point in my observations. Soon afterward I again took advantage of his rich experience. In one case after the usual efforts to reduce by non-operative methods, he exposed the joint, and after dividing such obstructing tissues as could be located and after failing to bring the head into the socket by the Kocher and other methods, under protection of the field of operation, he placed one foot against the axillary border of the scapula and pulled strongly outward on the arm in abduction, with immediate reduction of the dislocation. While the head had been considerably mobilized by the operation, to my mind, it was of much importance that the abduction method succeeded after the Kocher and other methods had failed. I valued this encouragement the more when I found that in my first case the dislocation had existed for eight months, and that an unsuccessful effort at reduction under ether had been made at the end of three months. I succeeded in the reduction only after the use of much force, but the after-course was quite uneventful.

I realize that the superiority of the Kocher method over all others in old as well as recent dislocations has become so firmly established that it will not be an easy matter to obtain consideration for any other. The abduction method, however, is an older one and has done good service in the past. Kocher's success with his method seems to have been greater than any one else has had with it in old dislocations, probably because in addition to knowing it better than any one else he risked more force than most surgeons would employ. His only failures were in those cases in which he could not employ more force by his method after fracturing the humerus. Such success as I have had with the abduction method is to be explained by the fact that I could use enough force to reduce the dislocation in every case without fracturing the humerus. The one failure was not due to inability to

reduce but to keep it reduced. It is my belief that it is distinctly superior to the Kocher method in old dislocations, and I have hoped that I could show that it was. In this connection the suggestion of Dr. A. C. Wood is most valuable. He said that the principle of the abduction method was exactly the same as that which Allis⁶ established for dislocations of the hip. By reversing the steps of the mechanism of the dislocation, Allis merely drags the femoral head back to the acetabulum through the same path by which it reached its dislocated position. Some years ago Dr. Allis gave me the following brief and simple illustration of the principle of his method: "If a boy after diving into the water were to come back feet first, he would be doing what I try to do in dislocations of the hip." Kocher considered that the effectiveness of his method depended upon the same principle as that of the Bigelow or circumduction method, and that the coracohumeral ligament of the shoulder is analogous to the Y ligament of the hip.

In the Bigelow method the Y ligament is depended upon to stand the chief strain in bringing the head back into the socket. This is accomplished by a series of movements calculated by twisting to shorten it and by using it as a fulcrum to pry the head into place. While the coracohumeral ligament may be the analogue of the Y ligament, as Kocher suggests, it is not nearly as strong as the latter, actually or relatively. Its upper single limb arises from the outer edge of the horizontal portion of the coracoid process, and soon fusing with the capsule runs without very distinct borders to both tuberosities, crossing the bicipital groove (Piersol). Kocher in his first paper, in which he introduced his method and in which he referred only to recent dislocations, stated that the rotating mechanism was destroyed and the method was rendered ineffective when the greater tuberosity was broken off or almost the whole capsule torn away. I have found the latter condition several times in my cadaver work. He found the greater tuberosity broken off in seven of his eight operative cases. He had no means of determining the frequency of this condi-

tion in his non-operative cases, except by the finding of crepitus which is a very uncertain sign. The X-ray has shown that this fracture is much more frequent than was formerly thought. In the presence of this fracture, I think, that the conditions are made relatively more unfavorable for reduction in old dislocations. Reunion may have taken place but in such a case it is likely to be faulty. But even if the coracohumeral ligament which is attached to the greater tuberosity remains intact, it becomes involved in the cicatricial tissue, because it is at the upper limit of the rent and is carried forward and upward to the site of the greatest cicatricial shortening of the repaired capsule. It would be difficult to calculate what its influence is under such circumstances, but it is fair to assume that it cannot be as effective in old as in recent dislocations. In reduction by the Allis principle, the capsule plays no part, except in so far as it must be torn to permit the reduction. We depend upon the strength of the humerus and, with firm fixation of the scapula, the force is applied through it to the shortened portions of the capsule. The traction is made in its long axis, and at the upper end the force, driving the head toward the socket, is applied almost directly to the bone. In the Kocher method the main force is applied to the lower end of the humerus, which represents a long lever, the fulcrum being at the attachment of the capsule to the anatomical neck. Of the four fractures produced by Kocher, three were at the upper end of the humerus. He recognized that the external rotation was the dangerous movement. This is eliminated in the abduction method.

It is generally recognized that the humeral head leaves the socket while the arm is in abduction. In the normal condition, when the scapula is fixed in its position of rest, *i.e.*, the position it occupies when the arm is hanging at the side of the body, the humerus reaches the limit of abduction at about a right angle with the body (Fig. 2). In the dislocation when the arm is in abduction, the head is anterior to and on a slightly higher level than the socket. Therefore, to reduce, the head must first be brought down to the level of

the socket so that it can be made to ride over the anterior margin of the socket, outward and backward. The traction on the abducted arm must be strong enough to overcome the resistance of the holding portions of the repaired capsule, and the traction or direct pressure outward and backward on the upper end of the humerus should not begin until the head is thought to be low enough. I know of no exact method of determining this point, but I have an assistant place the finger or thumb of one hand on the head so that he and I can observe approximately its degree of downward movement when the traction is made on the arm and the scapula is firmly fixed. I think it should move about a full inch. The head ascends to a somewhat higher level in old than in recent dislocations, because of the groove made in the head by the pressure against it of the anterior glenoid margin in the dislocated position. The longer the dislocation persists the deeper will the groove probably be. This groove will at least partly explain the fact that the elbow can usually be brought to the side of the body in old dislocations, while in the recent condition it springs away from the side. Since the resistance is in the fibrous connection between the humerus and scapula, if the scapula is firmly fixed, all the force applied in traction is being exerted on the short or holding portions of the capsule, *i.e.*, exactly where it can produce the best results and the least harm, the resistance offered by these portions of the capsule being the best possible protection against damage to the surrounding structures during the application of the force.

The following is a brief description of the method as I apply it:

Under full ether anæsthesia, I first try to tear some of the resisting capsule fibres by manipulation. The patient is then transferred from the operating table or litter to the floor with several blankets underneath and a pillow for the head. The Allis apparatus, which permits all the traction to be applied to the arm and thus to prevent danger to the elbow and wrist,

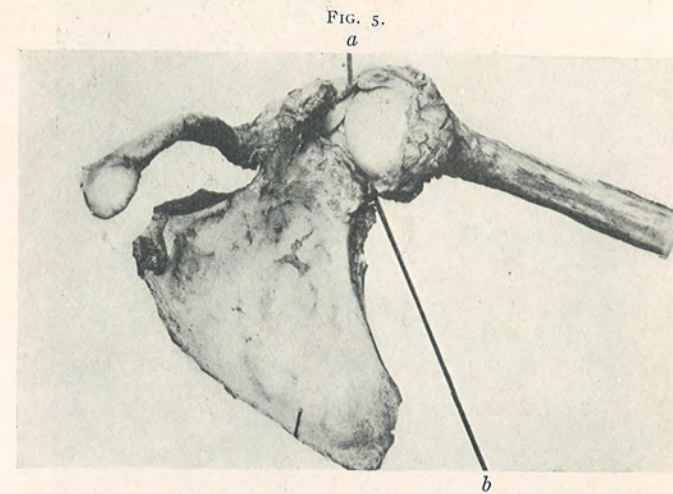


FIG. 5.
Showing the upper (a) and lower (b) margins of the rent carried forward and inward by dislocated head, which is rolled outward to show them.

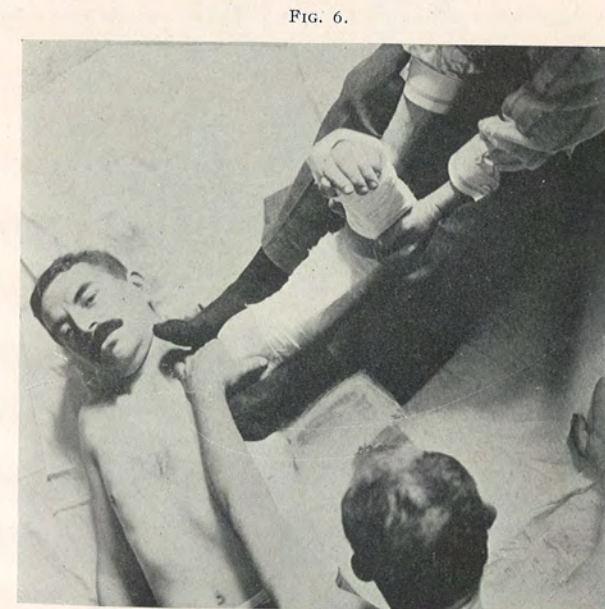
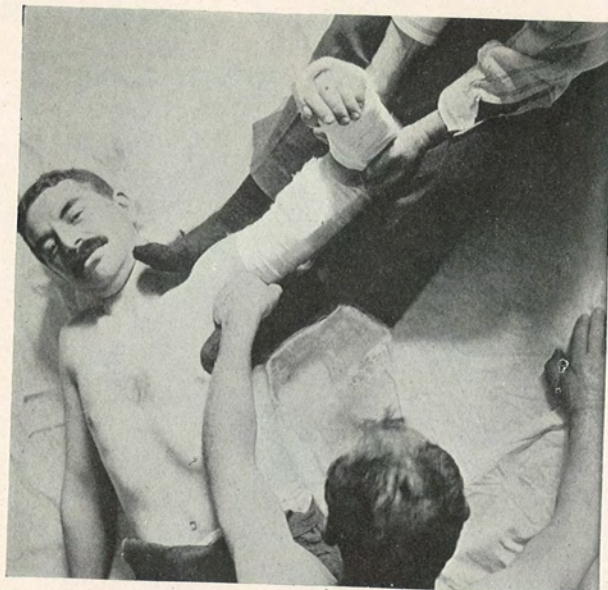


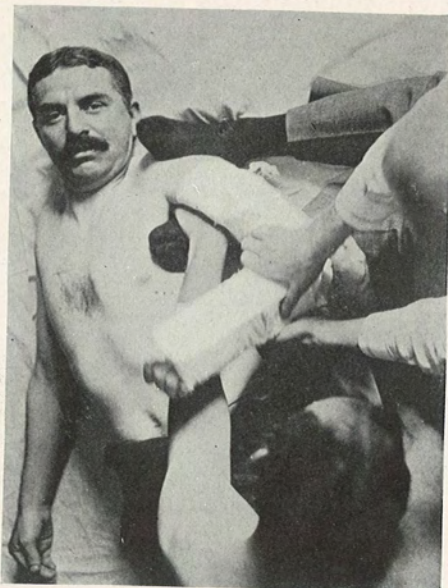
FIG. 6.
Abduction method with aid of two internal angular splints and wet gauze bandages. First step: Fixation of scapula by surgeon's feet while he makes traction on arm held somewhat beyond a right angle. Thumb of assistant's left hand marking position of humeral head, the rest of his body being kept as much as possible out of the illustration.

FIG. 7.



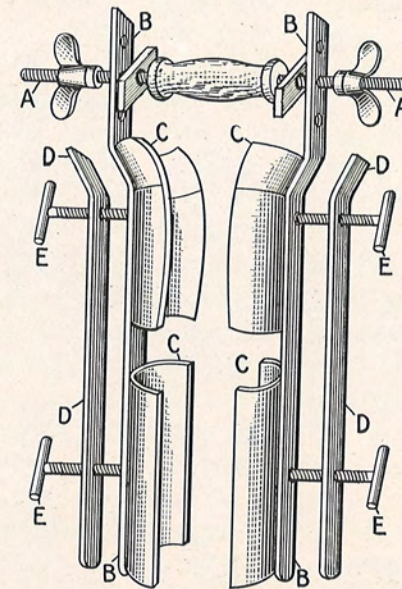
Abduction method. Second step: Head drawn down to level of socket and assistant pushing it toward socket. Folded sheet and second assistant may be employed to aid in this step.

FIG. 8.



Abduction method. Third step: Assistant, while he is still pushing on head toward socket and surgeon is maintaining traction, with his right hand pulls the lower end of the humerus to the side of the body.

FIG. 9.



Allis's instrument for assisting in the reduction of dislocations of the hip. AA, handle with four nuts to secure handle to upright bars, BBBB. CCCC, iron plates riveted to BBBB, approximated to or separated from BBBB. DDDD, movable bars that can be down to BBBB. The bandage is then applied around them and tightened by means of the handles EEEE. Previous to applying the apparatus, a wet bandage should be applied to the limb. It serves a double purpose, in that it protects the part from violence, and prevents it from slipping.

is then applied. (Two internal angular splints are always available, Figs. 6, 7, and 8.) I then take a sitting position on the floor in such a way that I can brace one stockinged foot against the axillary border of the scapula and the other against the upper border, while pulling on the arm in abduction. An assistant kneels alongside the patient below the arm with the thumb or finger of one hand on the dislocated head of the humerus (Fig. 6). Another assistant may, with a folded sheet, assist the first in forcing the head toward the socket. My first pulls, gradually increasing in force, test the downward movement of the head. When I think it comes down far enough I maintain the traction and ask the assistant to push strongly outward and backward on the head (Fig. 7), and when it seems to pass out far enough I ask him to pull in on the elbow with the other hand (Fig. 8). I have found that because of my position it is rather difficult to move the elbow inward myself. I have not tried the method without narcosis and I have found it difficult to apply the necessary force by grasping the arm above the elbow with my hands. Dr. Allis's apparatus made for applying traction to the thigh in dislocations of the hip, was an excellent aid in the dislocation of the shoulder (Fig. 9). I have seen Dr. A. C. Wood, however, reduce a dislocation of about three weeks' duration by grasping the arm above the elbow, placing one foot against the axillary border of the scapula, without taking the patient off the litter on which he was lying, without the aid of pressure or traction on the upper end of the humerus, and without giving an anæsthetic. The reduction was made with the first pull, and the patient merely made a slight outcry and then laughed when he found the shoulder in place. I am satisfied that there would have been more pain if the dislocation had been a recent one.

After the dislocation has existed two or three months, I believe that no non-operative method can succeed without the employment of a considerable degree of force, and in many cases very severe force will be necessary. With the abduction method I have described, I believe that a sufficient degree of force can be safely applied to place the head in the socket in most cases. What time limit or other contraindication the

method has, I do not know. In the attempt which I made after four years, I was satisfied that the failure was not due to the duration of the dislocation but to the contents of the glenoid cavity, as the movements of the head were quite sufficient to accomplish the reduction. Kocher found this condition in only two of his operative cases, all of which he regarded as irreducible by non-operative methods. In supporting the non-operative method I have drawn upon the experience and suggestions of those with whom I have been associated. In conclusion I wish to acknowledge an indebtedness that is none the less definite because it is based upon memory. For about fifteen years I had the privilege of seeing or assisting Professor J. William White reduce a considerable number of these old dislocations. I have always believed that he was unusually successful, and after considerable reading on the subject I have been more convinced of it. His rule was to attempt reduction if the dislocation was not more than three months old, and his failures were very few. In my opinion, his success was due to the fact that he persisted, first with one method, usually the Kocher, and then with another, having assistants make traction with a folded sheet and direct pressure in the axilla on the upper end of the humerus toward the socket, and if the various methods failed after the first trial, going back to one or the other, until finally he brought the head into the glenoid cavity. I believe that every failure brought him a step nearer to success by breaking still more the resistance that must be overcome in every case before the reduction can be accomplished, and that he succeeded because he persisted. I am certain that his success was an important factor in bringing me to the conviction that the solution of the problem in this condition was not in early operation on every case, but that in most cases only the proper method and persistency would be necessary to accomplish the reduction.

The effect of the fractures commonly associated with anterior dislocations of the shoulder is still little understood. They are usually the fractures of the greater tuberosity and

the anterior glenoid margin. The tendency has been to regard them as leading to insuperable obstacles to reduction without operation and this was rather encouraged by Kocher. My experience with them is small, but it leads me to believe that in most cases we shall be able to overcome by operation any obstacles arising from them, sometimes with, but often without, operation. Two years after reducing my case of four months' standing I operated and found evidences of both fractures. Codman⁸ recently found small fragments of the tuberosity adherent to the glenoid cavity, interfering with the reduction, and he has suggested that in operating on these cases the incision should be made posteriorly. This is undoubtedly true, because by the anterior incision one cannot obtain a good exposure of the glenoid cavity, since the humeral head is in the way. I believe, however, that the capsule resistance should first be broken by traction in abduction, so that when the glenoid cavity is emptied the head can be brought easily into the socket. It might be possible to divide the obstructing portions of the capsule through the wound, but I think it unlikely that it can be done as effectively as by traction on the humerus and fixation of the scapula.

CASES.

CASE I.—Woman, fifty years of age. Dislocation of right shoulder, reduced 8 months after accident. Unsuccessful attempt made at end of three months.

Mrs. M., September 3, 1909, fell headlong down a flight of steps, injuring her right shoulder. Physician diagnosed a sprain. Immobilization for a time and later given electrical treatments and massage. Dislocation recognized three months after accident, and attempt made at reduction under ether. Some months later she came into the hands of Dr. J. Bernard Mencke, who referred her to me April 21, 1910. On April 29, she was admitted to the Philadelphia Hospital on the service of Dr. A. C. Wood, and on May 2, which was one week short of eight months after the accident, she was etherized and after breaking up some of the axillary resistance by manipulations,

I had her placed on the floor on blankets with a pillow under her head. The scapula was fixed by two long strips of adhesive plaster about three inches wide, one passing over the upper and the other over the axillary border of the scapula, and the ends of each strip held by an assistant. One of these assistants placed his stockinged heel against the head of the humerus. I sat on the floor in such a position that I could pull on the forearm just above the wrist with the arm at slightly more than a right angle with the body. After pulling as hard as I could several times to bring the head down to the level of the glenoid, the assistant pushed with his heel on the head toward the socket and I brought the arm to the side, maintaining my traction in the meantime. After three failures to lodge the head in the socket in this way, I asked another interne to assist me in pulling on the wrist, when the reduction was accomplished. The arm was bandaged in the Velpeau position for three weeks and then released entirely. Notwithstanding the fact that I had been prepared to use much force, I was concerned particularly about the pressure of the heel of the assistant in the axilla, until on the following day the patient showed little or no discomfort and no signs of injury about the shoulder. At the present time abduction can be carried to about 140 degrees, while external rotation is still somewhat limited. She has no pain and can do most of her housework.

CASE II.—Woman aged sixty years. Dislocation of the right shoulder of 4 years and 3 months, and of left shoulder of 4 months' standing. Reduction on left side, failure on right side. Joint on left side opened 22 months after reduction.

Mrs. R., in the latter part of April, 1906, fell down a flight of stairs and injured her right shoulder. Did not seek professional advice until two weeks later. She then visited a hospital where a dislocation was recognized. She was given an anæsthetic and an attempt made at reduction. The arm was bound to the side and patient kept in the hospital two weeks, when she was discharged and told that everything would come out all right. About the first week in May, 1910, she slipped on a banana peel and fell striking on her left shoulder. About a week later she sent for a physician who diagnosed a dislocation of the left shoulder. With his heel in the axilla he pulled

on the arm, after which he said that the dislocation was reduced. The arm was bound to the side for two weeks, but during that time the bandage was removed every few days and the shoulder massaged. Dr. Mencke, at the German Hospital, in the service of Dr. G. G. Ross, who saw her some time later, referred her to me, August 8, 1910, with the diagnosis of a double subcoracoid dislocation, which was readily confirmed on examination and by the X-ray. She could abduct to about 120 degrees on the right side and the usefulness of the limb was very good considering the presence of the dislocation. On the left side she could abduct to about 50 degrees. She was admitted to the University Hospital August 9, 1910, on the service of Professor J. William White, and on August 10 was given ether for the attempt at reduction. She wished me to try to reduce the right shoulder if I succeeded with the left. After placing her on the floor as in the preceding case, a folded sheet was passed around the body transversely so that it covered the axillary border of the scapula and could be held at both ends by an assistant on the opposite side of the body. Another folded sheet was similarly placed but with its middle over the upper border of the scapula and its two ends passing obliquely downward and to the opposite side of the body where it could be held by a second assistant. In my stockinged feet I sat on the floor in the same position as in the preceding case, but placed one foot against the upper and the other against the axillary border of the scapula, and again grasped the patient's left forearm just above the wrist, an assistant taking hold of the arm just above the elbow. We two then pulled on the arm while the scapula was fixed by my feet and the sheets, until a slight tearing sensation was felt—it was also heard—and the head moved downward to what I thought was the level of the anterior glenoid margin. The assistant holding the sheet passing obliquely downward from the upper border of the scapula then placed one stockinged foot against the upper end of the humerus and pushed the head toward the socket. When it seemed to be in the socket the arm under traction was brought to the side of the body. After two such trials the dislocation was reduced on this, the left side, after having existed for four months.

The right shoulder was treated in the same way but after

four or five trials the dislocation was not reduced. There was distinct crepitus, and the X-ray, according to Dr. Pancoast, the skiagrapher, showed a fracture of the greater tuberosity. The head was carried repeatedly over the anterior glenoid margin well up into its normal position, but as soon as the traction and pressure were released it jumped back again into the dislocated position. I am satisfied that the posterior portion of the capsule was adherent to the glenoid surface, probably with a detached fragment of the greater tuberosity so that the cup was filled and the head could not remain in the socket. Kocher called attention to this condition, and other writers, as Lund, have emphasized it. Before the head can be placed in its normal position, the glenoid cavity must be cleared of these structures.

While the force employed in the attempt at reduction in the right shoulder of this patient was greater than in either of the two other shoulders, the left in this case and that of the first case, which were successfully reduced (or in any of the three successful reductions which followed), it seemed to me that the glenoid conditions and not the prolonged period during which the dislocation had lasted were chiefly responsible for the failure. I would infer, therefore, that while the duration of the dislocation is of importance, the adhesion of the posterior portion of the capsule, especially if it has been detached with a fragment of the greater tuberosity, is of far more importance. After failing to reduce the right shoulder, I bandaged both arms to the side of the body and supported both wrists in slings from the neck. On the following day I removed the bandages and asked the patient to abduct the right arm as far as she could and found that she could do so to about 90 degrees. I asked her if she had much pain in this shoulder and her answer was, "not much." During the night she had had considerable pain in the left shoulder which was reduced, but this had largely disappeared. I had expected to find considerable disturbance, especially in the right shoulder, but there was no noticeable swelling or pain and she permitted me to handle both shoulders, but the right particularly, with considerable freedom.

She left the hospital August 15, and received massage and passive motion at the German Hospital, under Dr. Ross's direction, over a prolonged period. I saw her again for

the first time about a year after her discharge. I was surprised to hear her refer to the arm of the side on which I had reduced the dislocation as her "bad arm." The motion was not as good as on the right side where the dislocation remained unreduced, and she had some pain in the left when she tried to move it upward. She was very anxious to increase the movement on the left side. I at first counselled against operation, but as she was a widow and could keep out of the almshouse only by earning her own living, and was anxious to have something done, I concluded to open the joint. The X-ray showed irregularity at the site of the greater tuberosity, and I thought I might find a loose fragment or irregularity, the removal of which would warrant an operation.

She was admitted to the Philadelphia Hospital on the service of Dr. A. C. Wood, and on June 15, 1912, with the patient under ether, I made an incision over the greater tuberosity downward and forward from the anterior margin of the acromion in the line of the fibres of the deltoid. The site of the subacromial bursa was exposed thoroughly but it had been obliterated. In its place was a layer of fibrous tissue about one-half inch thick, firmly adherent to the greater tuberosity but not to the under surface of the acromion, as was shown by the fact that the tuberosity and the layer of fibrous tissue moved freely under the acromion. In this case, at least, the obliteration of the bursa by adhesions was not responsible for the scapulohumeral limitation of motion. With the finger in the joint later it seemed evident that the limited abduction was due to the tightening up of a contracted axillary portion of the capsule. An incision was made into the joint between the supraspinatus and subscapularis tendons, careful search being made for the long tendon of the biceps, which is in this situation. It was found to have been torn from its attachment at the upper margin of the glenoid, and its torn end was adherent in the lower part of the bicipital groove, the upper end of the groove being obliterated by callus. There were two small bony projections on the upper surface of the greater tuberosity, evidently the result of an old fracture which had reunited. There were no loose pieces of bone here. The bony projections were smoothed off by a chisel. The finger in the joint found a deep

groove in the cartilaginous portion of the head just below and internal to the greater tuberosity. The anterior glenoid margin, including about the anterior third of the cup, had been worn away. Imbedded in the anterior portion of the capsule was a small fragment of bone, evidently torn from the anterior glenoid margin at the time of the dislocation. The groove in the head had rested on the worn portion of the glenoid margin during the four months in which the dislocation had remained unreduced, and the wearing away in both bones was the result of the pressure induced by the contact. By manipulations during the operation it seemed evident that the absence of the anterior part of the cup and the groove in the head permitted an abnormal range of movement out of the cup anteriorly, and that the rubbing of the rough portion of the head on the anterior glenoid margin in this abnormal movement was responsible for much of the pain which the patient had experienced. The condition found in the joint explains in a measure why it is so difficult to obtain full function after the reduction of an old dislocation. The operation, however, did not improve the condition of the patient materially, and she is compelled to remain in the almshouse because of the condition of her two shoulders. The pain, however, on movement of the joint is not as severe as before the operation, and the patient is still improving in that respect as well as in the range of motion.

CASE III.—Young man. Fracture lower third of right humerus and dislocation of same shoulder, of eight weeks' duration. Weak union and refracture of humerus. Reduction of dislocation. Death of patient three months later from lung disease.

Mr. D., referred by Dr. W. S. Cornell. November 9, 1910, while at work in a lumber yard, a pile of boards fell on him. He was taken to a hospital where a fracture of the humerus was diagnosed and the arm immobilized with splints. He was admitted to the University Hospital January 3, 1911, on the service of Professor Edward Martin, when I saw him for the first time and recognized a dislocation which Dr. Cornell had already found. He was etherized January 5 for an attempt at reduction. I was anxious about the character of the union at the seat of fracture, because Dr. Cornell reported that the patient had come to him with a very indifferently applied band-

age and a very small internal splint and with no fixation of the elbow or shoulder.

I gently rotated the arm externally and on the first movement a refracture occurred. I concluded, however, to try to reduce the dislocation. It would have been impossible with the Kocher method. I first applied to the forearm a wet gauze bandage, following a suggestion of Dr. Allis. I then padded with cotton and covered with a gauze bandage two ordinary right-angled internal splints, which I applied to the forearm and arm with another wet gauze bandage after soaking the splints in water. One splint was on the inner and the other on the outer side with the padded side of each splint facing the limb. The upper edges of the splints were left free of bandage just on the forearm side of the elbow. The object was to devise an apparatus with which I could make a strong pull that would be confined as much as possible to and in the axis of the humerus, beside providing some immobilization for the fracture. I had found that by grasping the arm above the elbow with my hands, I could not apply the necessary force, and in the preceding cases I had been concerned lest the traction on the forearm would do some damage to the elbow and wrist. I learned later that Dr. Allis had devised an excellent apparatus for a similar purpose in hip dislocations that is quite as effective at the shoulder and that I used in the last of my cases. With the patient on the floor under ether I took the same position as in the preceding cases, placed one stockinged foot against the axillary border and the other against the upper border of the scapula, and grasped the splints one in each hand where they were free of bandage. A folded sheet was passed around the upper end of the humerus and the two ends grasped by an assistant who placed one foot against the upper border of the scapula. A second assistant placed his hand against the head of the humerus in the axilla. When after pulling on the humerus and watching the hand of the assistant on the humeral head descend as far as I thought necessary, I asked the assistant with the folded sheet to pull and the other to push outward on the humerus toward the socket while I maintained the traction on the humerus. When the head seemed to be going out satisfactorily, I asked the assistant with his hand in the axilla to grasp the elbow

with his other hand and pull it toward the side. The first try failed but the second succeeded. The fracture of the humerus was immobilized by an internal angular splint and a shoulder cap, and the arm bandaged to the side of the body.

The ease with which the humerus was refractured eight weeks after the accident gave little hope of firm reunion, so that on January 30, the site of fracture was exposed by an intermuscular incision on the outer side of the arm. The musculospiral nerve was turned aside, the fibrous covering of the fragments curetted away, and the fracture splinted with a Lane plate, a small rubber dam drain being left in the lower angle of the wound. A dressing was applied and an internal angular splint used to reinforce the plate. The shoulder was then exposed for the removal of two small fragments of the greater tuberosity which were loose. The long tendon of the biceps retained its normal attachment, and the supraspinatus tendon from which the fragments were detached was sutured to the fibrous covering of the humerus. A small opening was made in the posterior part of the joint for drainage of the oozing that could not be controlled. The wound was closed and a dressing applied. A triangular splint was fixed in the axilla and kept the arm at nearly a right angle with the body. Both drains were removed on the third day. Healing occurred by first intention. The patient developed a severe cough after the operation. He gradually improved and left the hospital March 7. The shoulder was in good position and the motion improving. He visited me at my office several times but about a month after leaving the hospital I lost sight of him. He was much pleased with his progress at that time but his cough was still severe. I learned later that he died about three months after the operation. Before operation he had a pale sallow complexion, but he had not complained of being sick and examination did not develop any lung or other lesion. He did not show lung disturbances after the etherization and reduction. I think, however, that he must have had a latent tuberculous lesion in the lung, and that the ether and shock of the operation made it acute.

CASE IV.—Woman, aged fifty-eight years. Dislocation of right shoulder, 16 days old. Reduction.

Mrs. B., on August 20, 1911, fell down three steps, striking on her right shoulder. A dislocation was not recognized until

15 days later. She was admitted to the University Hospital, September 5, on the service of Professor Edward Martin. On that day, an interne made a vigorous effort to reduce by the Kocher method under nitrous oxide anæsthesia, without success. On the following day under ether anæsthesia, I reduced the dislocation easily, with the abduction method, probably because the resistance had been largely broken up by the interne's efforts. The X-ray showed a large fragment of the greater tuberosity widely separated from the head, a condition which, according to Kocher, renders the dislocation irreducible by his method. This probably accounted for the interne's failure. I feared that this fragment would give trouble later from faulty apposition, which fear was not removed by the skiagraph. On September 13, I exposed the greater tuberosity by a three-inch incision downward from the acromion and found that the fragment had fallen so nicely into place that I could find the line of fracture only on one side and could not detect any irregularity at the site of the tuberosity. The wound healed by first intention and the patient left the hospital on the seventh day after the operation. She now does all of her work as a housekeeper and there is now very little limitation of movement. Her only complaint is that she cannot button her dress in the back quite as well as with the other hand.

CASE V.—Woman, aged fifty-six years. Dislocation of right shoulder 25 days old. Reduction.

Mrs. B., on January 1, 1912, tripped over a piece of carpet to the floor, injuring her right shoulder. The physician who was called thought she was suffering from a fracture and said it was a hospital case. I saw her first January 23, and on January 26 I reduced the dislocation under ether at the University Hospital, on the service of Professor Edward Martin, by the abduction method as in the preceding cases. In this case I employed the apparatus devised by Dr. Allis for applying traction to the hip in dislocations of the hip. It worked perfectly at the shoulder, and permitted all the force to be applied directly to the upper arm. The handles allowed an excellent grip with both hands and easy manipulation of the arm. I did not use a folded sheet, but had an assistant make direct pressure on the head toward the socket, and when it had been forced outward

far enough he pulled the lower end of the arm to the side of the body with his other hand. The reduction was accomplished on the second attempt. The arm was bound in the Velpeau position and the patient sent home the same day. I did not see her again for four weeks because she had been ill at home. With the permission of Professor G. G. Davis, she received passive exercises and massage in the gymnasium of the Orthopaedic Department of the University Hospital. She now raises her arm above her head and is well pleased with the use she has of it. She reported by letter, recently, that she was enjoying very good use of the arm.

CONCLUSIONS

The mortality is lower and the average functional result following a non-operative reduction is better than following an operative reduction, but the frequently insurmountable obstacles and the great force necessary to a successful reduction have led to an increasing tendency toward operation.

The particular obstacle to reduction has never been satisfactorily demonstrated. While Kocher emphasizes other obstacles, as irregular bone formation, his main contention was that the chief resistance to reduction came from the contraction of the margins of the old capsule tear, which had closed about the head and thus prevented the raising of the capsule from the glenoid so that the head could not enter. On the basis of cadaver studies supported by clinical evidence, I believe that the chief obstacle is to be found in the cicatricial tissue at the site of the capsule tear and the shortening of the latter in certain portions, which must be more or less torn before the head can be brought back into the glenoid cavity. The rent in the capsule *per se* is probably never an obstacle to reduction by constricting the neck of the humerus and thus preventing the return of the head.

The Allis principle of reduction is a safer and more effective one than that of Bigelow. According to the former the humeral head is dragged back to the socket in almost a direct line, while by the latter the head is returned by leverage.

Kocher, out of 28 cases in which he attempted reduction by his method, reduced 25 and failed in 3, in each of which a fracture of the humerus prevented further efforts. The longest duration of the dislocation was 5 months and 22 days. Of 6 dislocations in 5 patients, 5 were reduced by the abduction method, one of them after 8 months. The humerus was not fractured by the efforts at reduction in any case. While a fracture of the humerus renders an old dislocation irreducible by the Kocher method, one dislocation was reduced after 8 weeks by the abduction method in the presence of a complete fracture of the humerus at the junction of the lower and middle thirds. In the one case in which the abduction method failed, the dislocation had existed for 4 years and 3 months, and there was probably an adhesion in the glenoid cavity of the posterior portion of the capsule with a fragment of the greater tuberosity, a condition which Kocher considered an insuperable obstacle to reduction without operation. Probably the best method of accomplishing reduction in such a case is first to break the fibrous resistance to reduction by the abduction method and then through a posterior incision to raise the fragment and capsule from the glenoid, when the head can be brought into the socket and the fragment replaced in its normal position, or it may be removed and the remaining capsule sutured in its normal position.

Because of the pressure and other changes in the humeral head and glenoid cavity from the long existence of the dislocation, it will sometimes be best to allow the dislocation to remain unreduced, especially if the limb is fairly useful and without troublesome pain, as in the shoulder in which the abduction method failed. While there was no mortality in Kocher's 28 cases in which no operation was done, in his 8 operative cases there was one death from sepsis. In the 5 cases in which the abduction method was employed without operation, there was no death, but in the case in which there was a poorly united fracture 8 weeks after the occurrence of the dislocation, the fracture was splinted 15 days after the

reduction. A latent lung infection, not recognized at the time, was much aggravated by the operation, and the patient died in consequence of it three months after the operation. The indications and contraindications for the abduction method can be determined only by further experience.

REFERENCES.

- ¹ Deut. zshr. Chir., xlv, 1911, pp. 581 and 916.
² Bost. Med. and Surg. Jour., 1897, cxxxvi, p. 397.
³ Lyon Medical, ci, 1903, p. 304.
⁴ ANNALS OF SURGERY, 1903, xxxvii, p. 756.
⁵ Berlin. klin. Wochenschr., vii, 1870, p. 101.
⁶ Samuel D. Gross Prize Essay, Philadelphia, 1896, The Hip.
⁷ Rev. d. Chir., xlv, 1911, pp. 581 and 916.
⁸ Bost. Med. and Surg. Journ. clxv, 1911, p. 115.

DR. OSCAR H. ALLIS said that he possibly stood alone in one respect, he does not think any one gets a perfect result in dislocation of the shoulder. The mechanism of the shoulder is very peculiar in some respects; as all know, muscle has the function of stretching within prescribed limits. When the head of the humerus is thrown suddenly into the axilla the short muscles of the scapula, its normal retainers, are apt to be torn in two or stretched with interstitial tearing of the muscle-fibres, so that after restoration there will be a later atrophy and tendency to a second dislocation. A tendency to a second dislocation is not necessarily because the capsule does not unite, but because it has no longer these little muscles to hold it in position. He was inclined to think that no one ever gets the full amount of motion after one of these dislocations. In a paper read before the College of Physicians on one occasion he stated the theory that the dislocation takes place through muscular action when the arm is thrown away from the body. He had seen a number of such cases. A person going downstairs makes a misstep and throws the arm out, producing a dislocation, although the individual does not fall. When Dr. Thomas said that he does not believe that the opening or laceration in the capsule is ever so small that the head cannot be replaced, he was sure experimental work bore that out. The old theory of a slit in the capsule cannot be held by any one that has done any experimentation.

DR. D. L. DESPARD said that traction prolonged over a num-

ber of days possesses some advantages over the method of applying a great force only at the time when reduction is being attempted. The former method of traction was successfully used recently in the dislocation of the shoulder of an exceedingly muscular man. The injury had existed for over six weeks and he had anticipated a great deal of difficulty in effecting a reduction. By means of Buck's extension apparatus, traction was started with 6 pounds, which was gradually increased to 10 pounds and continued over a period of 8 or 9 days. The patient was then anæsthetized and reduction effected by the Kocher method upon the first attempt.

DR. JOHN H. JOPSON said that he had always found Dupuytren's modification of Mothe's method easier than the Kocher method. It consists in drawing the arm directly upward fully extended in a broad sweep while counter-pressure is made by an assistant's fist in the axilla.

DR. A. P. C. ASHHURST remarked that all methods of reducing dislocations might be classified, either as *direct* or *indirect*. Dr. Thomas advocates one of the direct methods; it is the same as Stimson's or Sir Astley Cooper's, only it is applied differently. Stimson puts the patient in a sort of sling and lets the arm hang through a hole in this sling, attaching a weight to the hand. Cooper pulled the arm away from the chest, using the foot for counter-pressure. When the head of the humerus is brought away from the side of the chest and opposite the glenoid process of the scapula, then it is pushed or pulled into the socket, either by manual pressure as in Stimson's and Thomas's methods, or by leverage over the foot, as in Astley Cooper's method. All of these are direct methods, similar in principle to Allis's method for reduction of dislocations of the hip. In this sense there was nothing new in Dr. Thomas's application of this principle to the shoulder. Henry H. Smith's, Kocher's, and other methods of the kind are so-called indirect methods, like Bigelow's.

It was interesting, Dr. Ashhurst thought, to recall that anæsthesia not only made reduction much easier, but that it demonstrated that it was not only the muscles which interfered with reduction. Though Kocher was the first to recognize that the ligaments were the main obstacle to reduction in dislocations of the shoulder, as Moses Gunn had been the first to recognize their action at the hip, Kocher's claim that the coracohumeral ligament acted at the shoulder as did the iliofemoral at the hip

was demonstrated to be false by Farabeuf, who showed that the essential structure was the posterior part of the capsule.

The end results of dislocations of the shoulder formed an interesting subject. Though the reports of consecutive series of cases are meagre, it appeared that two out of three patients have been found to present persistent debility. Out of more than 20 patients under the speaker's own care, it had been possible so far to ascertain the end results only in five cases. In only two of these was perfect function regained; the three other patients were quite satisfied with their condition, though two of these had had the same shoulder dislocated twice or more subsequently, and the third had distinct limitation of motion, though subjectively he claimed his shoulder was "all right."

DR. GWILYM G. DAVIS remarked that this discussion had broadened out into recent as well as old dislocations. Etherization eliminates the consideration of muscle resistance, but as regards the difficulty of replacing luxations if no anæsthetic is given, then the muscles play an important part as a hindrance to replacement; in shoulder luxations it is often thought unnecessary to give an anæsthetic. Then the elimination of the muscles must be undertaken by other means, hence it is that use is made of the methods of Stimson, Astley Cooper, and others, by direct traction, etc., all with the idea of overcoming the muscle resistance. When this is overcome by an anæsthetic then the bones and ligaments only are to be dealt with, and the reason that the luxation cannot at times be reduced under these circumstances is because, as Dr. Allis has shown in the hip, the arm is not placed in the correct position. Thus, when Stimson puts the arm through the sling he lets the weight swing and the arm swings round until the capsule is opened and the head slips in. The same thing occurs in the Astley Cooper method,—when the arm is rotated it opens the rent and in goes the head, and it is the same with all the direct methods. In the old method of hanging the patient over the top of a door, the arm rotates until the capsule is open to its greatest size, when the head will slip in. If traction is made in abduction and backward, absolutely eliminating the muscles by anæsthesia, then the only thing to do is to rotate until the capsule is open, and push the head in. If it does not go in, then there is an irregularity in the condition; it is not a true simple luxation but one complicated with a frac-

ture, etc. When it comes to the method, the speaker agreed with Dr. Thomas that this is the proper method of reducing luxations of the shoulder. He had had several cases in which he had put the foot against the bedstead and pulled outward and backward and rotated; the longest time taken for reduction was fifteen minutes, while in others it was effected in three minutes. Kocher's method is unnecessary although effective if it is desired to reduce without an anæsthetic. Reduction does not depend solely upon the coracohumeral ligament. This ligament goes from the coracoid process, which is to the inner side, outward and in front. It has near it the long tendon of the biceps and the glenohumeral ligament. Above is that part of the capsule which frequently remains untorn in the cases in which the Kocher method is effective. One can determine on the cadaver that when the upper and posterior parts are intact one can rotate the humerus, and the head will move out from the chest toward the glenoid cavity. But if that portion of the capsule is torn, the head will bore between the glenoid process and the side of the chest, and in order to reduce such a luxation all that is necessary is to proceed with the direct method as the capsule is all torn. In such cases the Kocher method is ineffective. In the old cases in which that part of the capsule is intact then the Kocher method is effective because one can wind the remaining portion of the capsule around the upper portion of the head of the bone and push it outward, and it pushes in the old cases the supraspinatus, infraspinatus, and teres minor off of the glenoid process and cavity. The Kocher is the most dangerous method, because if the external rotation is made when the arm is down by the side, as is so often taught, then the coracobrachial is stretched so firmly over the head of the humerus that the lesser tuberosity catches on it and prevents it being rotated outward, and not infrequently the head of the humerus is jammed so tightly between the glenoid process of the scapula and the side of the chest that if one persists in rotating outward one will fracture the bone. It is far safer to do a wide abduction and traction.

DR. T. TURNER THOMAS (in closing) said that he did not mean to infer that the abduction method was new. It is much older than the Kocher method, but what he had tried to show was that one of the older methods is more effective than the new, or Kocher method, which has been the prevailing method almost

from its introduction. In regard to the Stimson method for recent dislocations, the underlying principle is the same as that which he had been applying in old dislocations. With regard to the disabling limitation of movement after the reduction of old dislocations, if the dislocation has existed for many months before reduction, the chances for a complete return of function are small. He would not say that it is impossible to get it. The return of function will be more rapid and will more nearly approach the normal after a non-operative reduction than after an operative reduction, as a rule. The underlying cause of the difficulty is essentially the same as for the corresponding condition found after the reduction of recent dislocations, *i.e.*, the stiff and painful shoulder of which so much has been written in recent years. The cicatricial contraction at the site of the capsule tear in the axilla will be more unyielding after the reduction of the old dislocations than after the reduction of the recent. He had, in a considerable number of cases of the latter variety, broken up this resistance by forcible manipulations under ether, without trouble and with very satisfactory results.

He had had very little experience with recent dislocations, since these are usually reduced by the family physician or the hospital interne, so that in discussing the abduction method he had confined himself to the old dislocations.

The superiority of the abduction method should be more evident in the reduction of dislocations of the shoulder associated with fracture of the surgical neck of the humerus, just as the Allis method is superior to the Bigelow method in the corresponding condition at the hip. The Kocher method may have the advantage in the reduction of recent dislocations, without an anæsthetic, in very powerful individuals. Such patients can resist more effectively the simple, direct pull in abduction than a series of more or less complicated movements as in the Kocher method, although the general spasm may effectively resist all these.

STATED MEETING, HELD NOVEMBER 4, 1912

DR. GWILYM G. DAVIS, President, in the Chair.

STAB-WOUND OF THE HEART; RECOVERY AFTER SUTURE.

DR. CHARLES F. MITCHELL presented a colored man, 59 years of age, who was brought to the Pennsylvania Hospital by the patrol at 5 P.M., July 30, 1912, having received a stab-wound of the left chest a short while before. He had been drinking heavily, and there was a marked odor of alcohol on his breath. His previous history was negative, except that he always used alcohol to excess. He was admitted to the service of Dr. Richard H. Harte, in whose absence Dr. Mitchell was called upon.

On admission temperature was normal, pulse 90 to the minute, while breathing was rapid and rather labored. There was no sweating, lips and conjunctiva blanched, heart sounds regular, but rather faint. Arteries atheromatous, marked arcus senilis. Area of cardiac dullness not increased. Right chest normal, but signs of pneumothorax over whole left chest. There was some dullness of left chest posteriorly. In sixth left interspace in anterior axillary line was a stab-wound, about $1\frac{1}{2}$ inches in length, from which bright red blood was flowing.

From above symptoms and physical examination a penetrating wound of the chest was diagnosed with probable injury to the heart. At 6.24 P.M., 1 hour and 24 minutes after admission, the patient was given ether preceded by ethyl chloride. The field of operation was sterilized with 3 per cent. iodine solution and wound in interspace enlarged. Left lung was found collapsed. The sixth rib was then divided and retracted, and immediately a large opening was found in the pericardium. The edges were rough and the wound appeared to be more like a tear than a clean cut. There were a number of clots found in the pericardium, which when removed showed a transverse cut in the heart, from which at each systole there flowed bright red blood. The cut in the heart was about one inch in length, apparently in the left ventricle about an inch above the apex. A